MODIS DATA STUDY

TEAM PRESENTATION

July 14, 1989

AGENDA

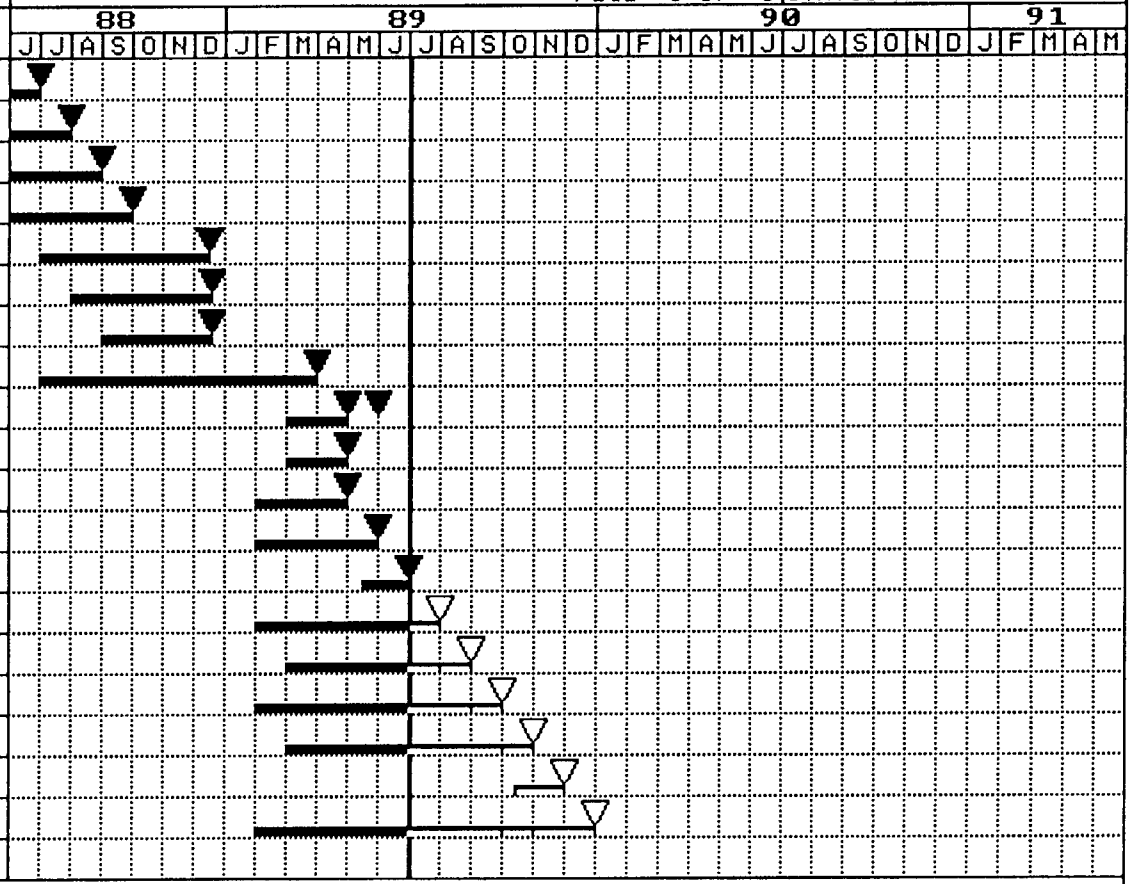
1. Status of MODIS Data Study
2. Atmospheric and Cloud Core Data Products
3. Land Core Data Products
4. Land R&D Data Products
5. Ocean Core Data Products
6. Ocean R&D Data Products
7. Some Thoughts on a MODIS Experimenter/Data Products Database Retrieval System
8. MODIS Data Product and Algorithm Factsheet
   - A Specific Data Base Example
9. Sample Earth Locations for MODIS

MODIS DATA SYSTEM STUDY
APPROVAL
ACCOMP.

Summary of Deliverables

ORIG. APPVL. 06/24/88
LAST CHANGE 07/01/89
STATUS AS OF 07/01/89

	MILESTONES
01	WBS Study Plans
02	Prelim User Data Prod Req'ts
03	Preliminary Operations Concept
04	Functional Requirements Doc
05	Prelim Data Processing Plan
06	Prelim System Specification
07	Operations Concept
08	Prelim Data Requirements Doc
09	Non-Advoc'y Rev'w Mat'ls
10	EosDIS/MIDACS I/F Comparison
11	Scenarios for Science Team
12	Prel TM Sci Product Summary
13	Support MODIS Science Team Mtg
14	Input Data Attributes Report
15	MODIS Data Prod Algorithm Rep
16	TM Product Analysis Report
17	MODIS SDST/ICT Req'ts Doc
18	Support MODIS Science Team Mtg
19	Data Requirements Doc
20	



Note:

ATMOSPHERIC AND CLOUD CORE DATA PRODUCTS
(Available at launch)

PRODUCT	SCIENCE TEAM MEMBER(S)
Total Column Ozone:	Joel Susskind, Paul Menzel
Aerosol Optical Depth (At six wavelengths):	Didre Tanre, Yoram Kaufman, Michael King
Aerosol Size Distribution Parameters (six classes):	Didre Tanre/Michael King
Aerosol Mass Loading:	Yoram Kaufman
Polarization over the Oceans (plane, degree, and total intensity):	Michael King, Didre Tanre
Aerosol Single Scattering Albedo:	Yoram Kaufman, Didre Tanre
Lifted Index (Atmospheric stability):	Paul Menzel, Joel Susskind
Temperature and Moisture Profiles:	Paul Menzel, Joel Susskind
Cloud Fractional Area:	Michael King, Yoram Kaufman
Cloud Area and Perimeter:	Yoram Kaufman
Cloud Optical Thickness:	Michael King
Cloud Effective Emissivity:	Paul Menzel, Joel Susskind
Cloud Top Pressure:	Joel Susskind, Paul Menzel
Cloud Top Temperature:	Paul Menzel
Cloud Water Thermodynamic Phase:	Mike King, Paul Menzel
Cloud Droplet Effective Radius:	Michael King

LAND CORE DATA PRODUCTS
(Available at launch)

PRODUCT	SCIENCE TEAM MEMBER(S)
Vegetation indices	Drs. Justice and Huete
Scene polarization	Dr. Vanderbilt
Surface temperature (modelling only, not data product; needs further discussion)	Dr. Wan
Thermal anomalies	Dr. Kaufman
Spectral surface albedo or other TBD	Drs. Kaufman and Huete
Snowcover	Drs. Hall and Salomonson
Level 2 land leaving radiances including atmospheric corrections	Drs. Kaufman and Tanre
Level 1 topographic corrections	Dr. Muller
Surface water cover mapping (may not be a core data product)	TBD

LAND R&D DATA PRODUCTS

PRODUCT	SCIENCE TEAM MEMBER(S)
Weekly soil adjusted vegetation index	Dr. Huete
Vegetation community types	Dr. Huete
Vegetation density maps	Dr. Huete
Global phenology	Dr. Justice
Regional (e.g., Sahel) land cover change maps	Dr. Justice
Global growing season length and its interannual variability	Dr. Justice
Fire products such as size, distribution, number, etc.	Dr. Kaufman
Geolocated surface types classed by surface materials	Dr. Muller
Surface roughness maps	Dr. Muller
Spectral bidirectional reflectance distribution function (SBRDF)	Dr. Muller
3D vegetation geometry and its change	Dr. Muller
Biome type based on SBRDF	Dr. Muller
North American weekly net photosynthesis maps	Dr. Running
North American weekly evapotranspiration maps	Dr. Running
North American weekly water and temperature vegetation stress maps	Dr. Running
North American annual net primary production map	Dr. Running
North American biome types	Dr. Running
Snow reflectance	Drs. Salomonson and Hall
Canopy structure such as leaf size, leaf layering, and size and spacing of plant crowns	Dr. Strahler
Standing woody biomass	Dr. Strahler

Green biomass	Dr. Strahler
Spectral bidirectional reflectance distribution function (SBRDF)	Dr. Strahler
Monthly global polarized vegetation indices	Dr. Vanderbilt
Land surface spectral emissivity maps	Dr. Wan

OCEAN CORE DATA PRODUCTS
(Available at launch)

Product	Science Team Member(s)
Sea Surface Temperatures	Drs. Otis Brown, Ian Barton, Vince Salomonson
Sea Ice	Dr. Vince Salomonson
Water Leaving Radiance	Drs. Howard Gordon, Dennis Clark
Chlorophyll Fluorescence	Drs. Mark Abbott, Robert Evans, Howard Gordon
Chlorophyll-A Pigment Concentration	Drs. Howard Gordon, Dennis Clark
Chlorophyll-A Pigment Concentration in Case II Waters	Dr. Kendall Carder
Detached Coccolith Concentrations	Dr. Howard Gordon
Surface Incident Photosynthetically Active Radiation (PAR)	Dr. Wayne Esaias
Attenuation at 490nm (K_{490})	Drs. Howard Gordon, Dennis Clark
Attenuation of PAR (K_{par})	Drs. Howard Gordon, Dennis Clark
Primary Productivity	Drs. Wayne Esaias, Mark Abbott
Angstrom Exponent (Ta <.6)	Dr. Howard Gordon
Single Scattering Aerosol Radiation (T_a <0.6)	Dr. Howard Gordon
In-situ Validation Observations (Required):	Drs. Dennis Clark, Frank Hoge, John Parslow, Kendall Carder, Wayne Esaias, and Mark Abbott

The above products are for the entire data set. The coverage is global for Case I waters (open ocean away from coastal regions). There will be a special regional data set for Australia and for the New York Bight.

OCEAN R & D PRODUCTS

Product	Science Team Member(s)
Chlorophyll Fluorescence Yield	Dr. Mark Abbott
Australian Data Products	Dr. John Parslow
Mid-Atlantic Bight Data Products (presumably chlorophyll concentrations, gelbstoff, detritus concentrations, water leaving radiance, etc., for this region)	Drs. Frank Hoge, Wayne Esaias
Total Suspended Materials (Type I and II waters)	Drs. Dennis Clark, Kendall Carder
Pigment Concentration (Type 2 Water)	Dr. Kendall Carder
Regional Basins Primary Products (Type I and II Waters)	Drs. Mark Abbott, Wayne Esaias
Gelbstoff Concentrations	Dr. Kendall Carder
Detritus Concentration	Dr. Kendall Carder
Sea Surface Temperature Quality Assessment Field	Drs. Otis Brown, Ian Barton
Objectively Analyzed Sea Surface Temperatures	Dr. Otis Brown

Some Thoughts on a MODIS Experimenter/Data Products Database Retrieval System

Why is a Database Required?

- Single Point for Information
- Useful Data Study and Analysis Tool

Existing Software and Data

- EosDIS Prototype Database
- MODIS Data Products and Field Experiment Fact Sheets

Application Types

- Retrieval of Predetermined Reports (Addressed in Prototype)
- Query-based Retrieval (e.g., How many data products are predicated on the availability of AIRS data? [This information is needed by the MODIS study team.])
- Report Generation

Yun-Chi Lu's Prototype

- User Friendly
- Information Retrieval Tool for Scientists
- Based on Questionnaires, Interviews, and MODIS Fact Sheets
- Five Files (Investigators, Eos Instruments, Data Products, Field Experiments, Metadata)

MODIS-Based Application

- Menu-Driven
- Users to be Specified
- Initially for Data Products, Metadata, and Field Experiments
- Possibly can be Combined with Yun-Chi Lu Application

Potential User Populations

- MODIS Study Team
- MODIS Science Team
- EosDIS-wide
- On a Specific Platform or Instrument Basis

Implementation Alternatives

- Individual Copies on the User's PC (with Periodic Updates)
- Centrally Located Database w/Dial-ups
- Sample Relational DBMSs
  - RBASE
  - dBase
  - ORACLE
  - FOCUS
  - Others
- SQL
  - Query and Formatting
  - Menu Implementation

Compatibility Issues

- Existing/Proposed EosDIS Applications/Hosts
- NASA Climate Data System
- Other NSSDC Applications/Hosts

What is Next?

- Evaluate, Use, and Improve Existing Prototype
- Initiate Development for MODIS Prototype
  - Existing System
  - Initial Database Size
  - Estimated Timeframe
- Considerations
  - EosDIS: Emphasis is on refinement of format to evolve into an EosDIS database.
  - MODIS: Emphasis is on support to MODIS Data Study Team and Science Team, both now and later.
  - Integration: Can a MODIS database eventually be integrated into an EosDIS database?

Some Sources for Data Elements

- Data Product Fact Sheet (attached)
- Field Experiment Fact Sheet (attached)

Selected Candidate Key Data Elements

- Data Product ID Code
- Investigator's Name
- Ground Truth Instruments Used
- Scientific Disciplines

MODIS DATA PRODUCT AND ALGORITHM FACTSHEET

DATA PRODUCT NAME: Level-2 Fast Delivery Sea Surface Temperatures (deg. C)

DATA PRODUCT ID CODE: OL2IB0005

ALGORITHM(S) NAME: TBD
MACHINE USED FOR DEVELOPMENT: TBD
OPERATING SYSTEM: TBD
LANGUAGE: TBD
CDHF MIPS NEEDS: TBD
DEVELOPER: Dr. Ian J. Barton

SCIENTIFIC DISCIPLINE(S): Oceans/physical properties

LEVEL AND/OR CATEGORY: Level 2, standard, on demand only

SPATIAL COVERAGE: Global
SPATIAL RESOLUTION: Pixel footprint size (variable)

TEMPORAL COVERAGE: Launch date (Dec.,1996) onwards. (on demand only)
TEMPORAL RESOLUTION: Swath time.

INPUT DATA:
NPOP-1 PLATFORM DATA: TBD
MODIS-N ANCILLARY DATA: TBD
MODIS-T ANCILLARY DATA: TBD
MODIS-N CHANNELS: 26 to 40 (TBD)
MODIS-T CHANNELS: None
OTHER MODIS DATA PRODUCTS: None
OTHER EOS INSTRUMENTS: AMSU, SCAN-SCAT, ALT (validation); AMRIR requested but not on NPOP-1.
NON-EOS DATA: None
GROUND-TRUTH DATA: Ground-truth SST Experiments (O16V)

DATA VOLUME ON-LINE REQUIRED: TBD

ESTIMATED DAILY DATA VOLUME GENERATED: 1550 MB

DESIRED DISTRIBUTION MEDIA: TBD

TIMELINESS REQUIREMENTS: Within 72 hours

ADDITIONAL COMMENTS/TRACEABILITY:
Proposal, pages: TBD
See corresponding Level 3 rectified and daily averaged data product for more details.
Level 2 data products are not rectified but contain all the distortions in viewing as observed by the instrument.
It is not clear if Level 2 data products will be archived, but only exist for a short period until the corresponding Level 3 data product can be generated.

FIELD EXPERIMENT FACTSHEET (C01V)

FIELD EXPERIMENT NAME: Reflectance-based Calibration Experiment I (C01V)

PURPOSE: Use in-situ radiation measurements and accurate radiative transfer codes to predict satellite altitude radiance values so instruments can be calibrated.

PROPOSER: Dr. Philip N. Slater

PRE-LAUNCH OR POST-LAUNCH(?): Post-launch

SCIENTIFIC DISCIPLINE(S): Calibration/radiative transfer

GROUND-TRUTH INSTRUMENTS USED:

1) U-2 overflights with radiometers.
2) Barometric pressure.
3) Total precipitable water from radiosondes, relative humidity at surface, and temperature measurements.
4) Spectral optical depth from portable spectroradiometers at about 1500 locations.
5) Helicopter low level flights

LOCATION(S): White Sands, NM; Edwards AFB, CA.

TIME(S): About three times per year when MODIS, Landsat, SPOT, AVHRR, AIS, AVIRIS, and other remote sensors can sample the site nearly simultaneously.

MODIS DATA PRODUCTS REQUIRED: Level 1A counts data.

TIMELINESS REQUIREMENTS: TBD (probably several days later is adequate since considerable data collection is required and several weeks of analysis may be required).

COMMUNICATION REQUIREMENTS: None

SPECIAL MODIS-T OPERATION MODE(?): Yes: Probably in stare mode.

IMPACT ON MODIS Data System: None apparent; specialized data sets to DADS.

ADDITIONAL COMMENTS:

Collaborative effort with Salomonson is possible.

Dr. Kaufman also plans to use desert sites as calibration targets.

MODIS Data Product and Algorithm Factsheet Data Base
(A specific data base example.)

There are approximately 239 MODIS Data Product and Algorithm Factsheets. Each factsheet contains at least 29 separate data attributes. Examples of data attributes are

- Data Product ID Code
- Spatial resolution
- Desired Distribution Media, etc.

Each data attribute may have several significant facts associated with it;e.g., Non-Eos Data may list different data sources such as SPOT, Landsat-6 and why the product is required.

If you ask the question, how many MODIS science team members require Landsat TM products (and who are they) if takes time to page through the factsheets and find out. Then you aren't sure if you have missed one.

A data base is just a collection of data in an organized form which can be queried. The factsheets are in an ideal format for inclusion in a data base because their information can be entered directly without any coding. Once data is entered into the data base, you can manipulate or query it to answer your questions. You can print the data, and you know that the responses are correct.

The example is a query using the input data for as the report. It represents the users that requested SPOT satellite data as a non-EOS product. (Reports are the normal method of generating printed outputs.)

I estimate that a typical typists could enter all of the fact sheets in three working days. The data base took about 1.5 hours to design and load with nine data sheets.

Skip Edit Change Add Reset Delete Quit

Input data form for MODIS database

Name:Soil Surface spectral map
roduct ID code:LL3AHØØ74 Language:FORTRAN or C
Algorithm Name:Radiant transfer/spectral mixture mixture model
Computer:Sun Developer:Dr. Alfredo Huete
Operating System:DOS and/or Sun
Scientific Discipline:land/ biological Produce Level:Level 3 st
Spatial Coverage:Global Spatial Resolution:I kilometer; gridded t
4-1Ø km
Temporal Coverage:Launch date onward Temporal Resolution:Da
ly L-2, bi-weekly L-3
NPOP-1 Platform data:Ephemeris
MODIS-N Ancillary Data:TBD
MOTIS-T ancillary Data:None
MODIS-N Channels:1-4, 5-13,2Ø-22,26, 35
MODIS-T Channels:All - over regional sites
Other NODIS Data Products:LST, atmospheric corrections

Other EOS Instruments:HIRIS over regional validation sites

Non-EOS Data:DEM/ SPOT/ TM/ AVIRIS
Ground Truth:regional test sites: soil transects and reflectances

SAMPLE EARTH LOCATIONS FOR MODIS

49 points of intersection between the Earth geoid and the MODIS-T line of sight (LOS) were navigated and plotted on the attached figure. The points are for scan and tilt angles of 0°, ±15°, ±30°, and ±45°. The assumed pitch, roll, and yaw are taken here to be nominal (0°), and the satellite is located 705 km above the equator over Borneo. The actual viewing angles range between 0° and 60°, with the Earth's limb positioned at about 64°.

The set of points chosen here do not correspond to the MODIS-T scanning pattern for two reasons: (1) only one tilt angle will be used at a given time, and the instrument probably will not have the capability (or requirement) to rapidly vary the tilt angle; (2) the sets of seven points across-track in each of the sample scans is quite a subset of the many 1 km IFOV's to be taken by the instrument. The scan for 0° tilt angle is also representative of a MODIS-N scan, with the scan angle only extending out to ±45°, rather than ±55°.

Digital elevation model (DEM) data at five-minute resolution has been read from the "Five Minute Global Data" from the National Geophysical Data Center. Examples of these data have been recently plotted and displayed. The combination of the DEM data and a viable Earth location algorithm will now permit the study of various scenarios for anchor-point Earth location and interpolation.

MODIS SCAN SPOTS